Decision Aids and Data Processing

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I. Subject Matter Under Consideration

1. Electronic Processing Potentials

Outlining and explaining the development and present state of data processing, including the support offered by it for decision-making in public administration in Germany, in the final analysis, means endeavouring to answer the question as to what extent public bodies are exploiting the potential offered by such new technology. It is important to realise that – after centuries of dealing with paper – electronics is the first technology providing a true innovation for administrative techniques: an essential characteristic of traditional office work, which is still decisively preshaping our ways of thinking and acting, namely that information always goes with a medium like paper, no longer applies; locality is replaced by ubiquity. The result is an erosion of the traditional meanings of space, time and hierarchy. In this context, electronic data processing (EDP) is considered to provide a radically altered basis for the definition of the public administration's conception of itself and its structures. It becomes necessary jointly to harmonise the strategies for substantive administrative action as well as the administration's systems of information, which implies, of course, the co-ordination of developments that have tended to remain apart during the first forty years of electronic data processing.

2. The Concept of Information and Communications Technology

Electronic processing equipment does not only include the various kinds of computers – mainframes, minicomputers, workstation computers, and personal computers or notebooks – but also the entire array of peripherals that can be interfaced. These have come to comprise all major types of office equipment which were formerly operated in isolation from one another. The trend is for computers and peripheral equipment to grow together both via local, regional and supra-regional networks of narrowband to broadband design (information highway) and through the exchange of data media (from floppy disks via CD-ROM to chip cards). The computer is thus far more than a data-processing machine: it is a multi-purpose information and communications system admitting the processing and exchange of data in all the forms of communication essential to the administration (recorded and audible messages and image communication), and world-wide at that; indeed with the inclusion of the mobile telephone service, which is rapidly gaining in importance, this is possible literally from any location.

Together with this hardware, the system software (comprising operating systems, user interfaces, database systems, network and communication software) forms the information and communications infrastructure (telecommunications) needed to operate the application software.

3. Confinement to Qualitative Aspects

As a high-performance administration serving a modern industrial and service society with clear signs of a development towards an information society, the German administration is differentiated and must be considered as a high-tech apparatus, with all due allowance for more precise information on this to follow. It is both this fact and Germany's federal structure with further self-administration in the local-government, university, social-insurance and other sectors that make it difficult to gain a general overview of data processing and decision aids. There is an enormous variety of information and communications infrastructures, of applications, as well as of institutions exercising control and providing assistance. In this country there is no dedicated agency or institution pooling information on these subjects. It is for this reason alone that the present reflections must largely concentrate on the qualitative aspect, which, however, offers the advantage of having to steer clear of undue detail, and thus remaining able to see the wood in spite of innumerable trees.

II. Information Systems

1. Information and Communications Infrastructure

The information and communications infrastructure available to the German public administration can be aptly described as a three-level model comprising computer centres, departmental computers and workstation computers, with a trend towards client/server architectures. However, development up to the current state of affairs occurred in stages, the marks of which are still visible in the EDP landscape.

With the emergence of remote data transmission in the late sixties, the initial batch processing in mainframes was developed further into terminal systems with remote batch processing, inquiry procedures and centralised workflow management in interactive operation. As a general rule, these operations were department-related and executed with manufacturer-bound – i.e. different – architectures. With the wish for inter-administrative data exchange growing stronger, the hindrance resulting from the "language barriers" due to this heterogeneity became increasingly cumbersome. The *Land* (federal state) North Rhine-Westphalia was the first authority to react to this. As early as in 1980, it set up a data-switching system which – as packet-switched long-distance network based on Standard X.25 – allowed communication between the numerous proprietary systems.

With the rise of minicomputers and their decentral operation as departmental computers, to each of which several workstations could be connected (multi-station systems), a new problem arose. There was a large number of such minis, each fitted with its proprietary hardware and the respective dedicated operating systems; this hampered the porting of application programmes to another hardware environment or switch to another manufacturer. To limit this wide variety of types and protect investments in both hardware and software, a "UNIX ordinance" was passed by North Rhine-Westphalia in 1988, prompted not least by the European Community's Directive 87/95; this ordinance compelled all those procuring multi-station systems to choose a UNIX operating system, a rule which was soon followed by all other *Länder* and also at Federal level. The power of demand thus created produced a clear effect. Just a few years later, it was nigh on impossible to find anyone offering departmental computers without UNIX.

In the mid-eighties, when personal computers spread at the third computer level, a comparable multiplicity of types had no chance to develop, since uniform hardware (Intel) and a uniform operating system (MS-DOS) became generally accepted as industrial standards.

With the emergence of client/server architectures in the nineties, however, compatibility problems are being encountered again. The trend is to share the application software with its three main components (application logic, data management and presentation) among servers and clients in order to reap the benefit of a division of labour. Consequently, the generated components must be able to co-operate via a network. As different operating systems as well as different types of hardware have come to be available to the servers (with UNIX, Windows NT or OS/2) and also to the clients (with MS-DOS, OS/2 or Windows), new communication problems are arising. But a solution is in sight, namely middleware, a software located between the co-operating application units and – by making use of the high operating speeds attained by present-day processors – doing the necessary translations in real-time processing. The different types to be allowed for in this context are manageable since there are now few hardware platforms and operating systems left (certainly not least thanks to the UNIX ordinances).

Along with such necessary modernisation of its information and communications infrastructure, the German public administration is facing the task of having to improve considerably its computer equipment ratio. Even in the *Land* administration of Baden-Württemberg, which counts among the more technology-friendly of the *Länder*, in 1995 only twenty per cent of appropriate workplaces were actually fitted with electronic data-processing equipment. In other administrations, in the federal authorities, for instance, equipment ratios even fall well short of this level. But in some places there are also higher computerisation ratios, as for example in the Kommunale Rechenzentrum Niederrhein, a local-authority computing centre at Moers, where about seventy per cent of office workplaces in the participating municipalities are already fitted with electronic equipment. Moreover, the phenomenon that, economically speaking, it takes an inordinately long time to set up a worthwhile technological outfit is equally in evidence with application software; in one administrative branch with many authorities of the same kind, it actually took almost twenty years for the decision to introduce EDP to be implemented all the way down the line to the last authority.

The installation of the so-called information highway as a broadband connection between alt participants in electronic multimedia communication, however, has already made great strides in Germany as compared with other countries. Long-range networks, in particular those operated by Deutsche Telekom, are mostly optical fibre networks, thus admitting transmission speeds that do not set any perceptible limits to potential applications. The access networks are based, on the one hand, on a close-knit telephone network connecting virtually every household; the system is presently being digitised as ISDN and expanded by means of ATM into broadband ISDN in accordance with the Euro-ISDN standard that was agreed upon by twenty European countries in 1994. In addition to this, there is a cable television network available to two-thirds of all households.

This favourable starting position will be improved further as a result of the regulative policy action taken by the European Union aimed at a liberalisation of the telecommunications market (abolishing monopolies of network providers and telephone services by the end of 1997). New competitors from the energy utility sector, from among local governments (who have discovered here a new field of activity) or from among companies and institutions

operating corporate networks capable of being opened up to other users, will contribute to galvanising the market.

2. Applications

Turning to the application of the information and communications infrastructure in federal, Land and local-authority administration, we find an extraordinarily wide variety. From a historical perspective, one can observe how the sequence of technical computer generations accounts for the corresponding generations of applications. Yet, frequently, the course adopted was to build on existing solutions as there appeared to be neither the time nor the money for a more radical overhaul.

For a long time now practically all routine administrative work has been executed with the aid of computers. The initial batch processing has meanwhile been replaced almost everywhere by interactive operations, employing the three levels of computing, i.e. computer centre, departmental computer and workstation computer, so that sequential processing, inquiries, evaluations or transaction processing can be launched from the workplace. This has led to the development of in some places quite complex software packages for fiscal and labour administration, for the social-welfare offices, for residents' registration, land surveying or manpower management. However, these are often oriented vertically to the respective authority's departmental hierarchy, thus hindering inter-connections beyond the boundaries of the department concerned.

With the rise of databases, online services have been spreading, some of them also available on CD-ROM. As illustrative examples, reference may be made to "Juris", the juristic information system with its documentation of established law, jurisdiction and legal literature, to the inquiry system operated by the Federal Government's Press and Information Office, or to local council information systems. With the progress of networking, the number of online information providers is rising as well; many municipalities and universities, but also federal and *Land* authorities, have recently begun to present themselves in the Internet's World Wide Web. Yet surprisingly, the interest manifested by our administrations in the use of online services is relatively low compared with other countries.

In the eighties, interoffice communication made its entry into German administrative authorities with the departmental and workstation computers. Interoffice communication means electronic mail, documentation filing, scheduling and space administration, but also the so-called personal or end-user computing (word processing, spreadsheet analyses, file management or business graphics) as well as specific applications which hitherto had "taken a back seat" due to a certain ponderousness of decision-making processes in the EDP sector (at the local level, for instance, applications in the registry, social-welfare or car-registration offices). All the same, two obstacles continue to hinder full utilisation of interoffice communication potentials. On the one hand, the surprisingly low number of workplaces fitted with interoffice communication equipment sets certain limits, a fact which also impedes the implementation of welcome decisions like those taken by the Conference of the Ministers of the Interior or the Baden-Württemberg *Land* government and requiring from 1995 onwards – all correspondence to be sent exclusively by electronic mail wherever technically feasible. The other obstacle is that both individual and departmental applications in interoffice communication have spread sporadically.

As a result, electronic workflow management stands supreme amidst the present development of applications. Here, the information and communications infrastructure now available is

employed to integrate administrative operations and procedures in a process-oriented way from start to finish, incorporating all applicable programmes and data and all bodies concerned, all this being rendered feasible from any workplace by making use of the program and data resources with a uniform user interface and without any media discontinuities. The necessary technical basis is generally provided by client/server systems. These require conversion of the outdated proprietary user systems, many of which were designed as early as in the sixties and installed in the seventies. An example of this is FISCUS, intended to replace the existing automated taxation procedures and already in operation in pilot versions. As a client/server system, it links the workplaces within the various tax offices via local networks and, via public networks, it also connects all local tax offices and computing centres, and in future it will even connect tax consultants and taxpayers.

3. Resources

The funds and staff positions employed for information and communications technology (ITC) can be specified for selected spheres only. In the Baden-Württemberg *Land* government, about a thousand out of 220,000 jobs (or just under one half per cent) were assigned to ITC in 1995. In the same year, budget expenditures on ITC in Baden-Württemberg amounted to DM 500 million; compared with the overall budget volume of DM 60 billion, this is equivalent to 0.8 per cent. As to the Federal administration, the authority responsible for co-ordination in this field can specify only the number of staff positions dedicated specifically to information and communications technology; in 1995, this came to almost 6,000 jobs, or approximately one per cent out of the total number of some 600,000 jobs. As regards the Kommunale Rechenzentrum Niederrhein, approx. 1.9 per cent of all civil-service positions in the participating local authorities and the computing centre are assigned to ITC, the total of all respective expenditure in the overall budget amounting to around two per cent.

III. Electronic Data Processing Organisation

The most outstanding characteristic of EDP organisation in Germany – interpreted as the distribution of information and communications functions to various responsible bodies – is probably the high degree of alignment and inter-administrative co-operation. Yet different phases and focal points can be made out here.

During the pioneer period in the fifties and the expansion phase in the sixties, computers were still used with little regard to inter-authority co-operation. EDP appeared at the right time to provide some solutions to the rapidly growing strain on public administration at a time when the labour market was extremely tight; and, initially, it spread in a sporadic fashion.

In the late sixties, however, a trend was already set towards order and alignment in the EDP landscape. Computer purchasing and operating costs were high, EDP experts were scarce, the overlapping of state and local-government functions called for harmonisation, an abundance of data made available by EDP had to be exploited to gain management information, and the impending imbalance of computerisation between urban and rural areas needed to be corrected. In organisational terminology, the solution was to be as follows: centralisation of physical resources; the procurement, programming and operation of computers were united in computing centres, these being shared, whenever possible, by several authorities. Besides these, specialist computing centres were set up for the big divisions like fiscal, labour or police administration. Questions of EDP harmonisation were delegated to co-ordinating and consulting bodies, *Land*-level or local-authority automation committees or similar groups.

On the one hand, this typical aligned innovation strategy (bearing resemblances to outsourcing today) proved to be a good thing: computers, i.e. novel and expensive equipment, could be turned to use in a surprisingly short time and on a remarkably broad basis. Yet it also revealed disadvantages as computer practice was gained and it became more and more evident just what significance computerisation had for administrative policy in helping users to reach their targets. The very duration of harmonisation procedures, which had to be agreed upon on a broad basis, possibly even *Land*-wide, restrictions placed on the highly valued notion of individual variety by compulsory conformity, or what is referred to in German as the "convoy syndrome" (meaning that the slowest determine the type, extent, date and costs of progress) – all these facts were perfectly capable of restricting the organisational sovereignty of various users, thus driving the aligned EDP infrastructure into a legitimation crisis. With the steeper rise in technical progress (such as minicomputers, workstation computers, networking or database systems) in the eighties, this crisis was exacerbated as this progress allowed users to change over to decentral, autonomous EDP and, at the same time, posed a challenge to the computing centres, requiring them constantly to update their equipment to keep it state-of-the-art. The latter fact presented considerable difficulties so that today's EDP infrastructure is marked by a broad spectrum from ultramodern to outdated systems (partly still without PC, networking or databases).

The characteristic target of our times is to close the gap between users' expectations and the options offered by the information and communications infrastructure. What this means for the EDP-using authorities is that they must recognise that an essential portion of EDP functions, namely politico-administrative control, forms part of the administration's cardinal functions and should on no account be executed by way of outsourcing; as a strategic instrument, ITC must be brought into harmony with the authority's own model of administrative structure. For the DP centres, this means that structures must be worked out to make it possible to translate the progress in ITC into the service offers needed by the user authorities to attain their strategic aims; this process is under way, combined with an obvious concentration on a small number of units of a critical size permitting today's heterogeneous hardware, system software and application systems to be operated by appropriately specialised and qualified staff.

IV. Qualifications

Public administrations, on the one hand, are major users of information and communications equipment; at the same time, they exercise a crucial influence on the further development of information and communications technology as well as on its application in the social sphere. Therefore, an adequate knowledge of ICT on the part of the civil service is of critical importance. This applies not only to EDP experts but also to staff in specialist administrations and in top management positions, partly because of their role as users of ITC, and equally as an effect of their capacity to control the employment of such technology, not only within their own scope of responsibility (coordinating the information system with administrative strategy), but also with due regard to social effects outside the administration (paving the way for the installation of information and communications equipment or setting up barriers to its use).

Accordingly, assessments of endeavours to provide training and qualifications must distinguish between two groups of curricula. Ort the one hand, there is the question of "What can ICT do for me?", i.e. knowledge about the availability and operation of such equipment at the workplace, either for online database inquiries or for workgroup computing (from electronic transaction processing via communication to scheduling). For despite the fact that

information and communications equipment has become much easier to use (with graphic user interfaces, for example), the notion of ITC without specific training continues to be utopian. On the other hand, there is the question "What must I do for ITCT", i.e. know-how about layout, command and control, involving familiarity with the potential of the equipment to improve efficiency in each user's range of responsibility; also, it implies the ability to communicate with information and communications experts, a capability which is gaining ever greater importance due to the interdependence between administrative information systems and administrative strategies, further reinforced by the trend in new administrative concepts to return responsibility for resources back to the line. It goes without saying that such curricular subjects cannot be imparted in a course of initial professional training alone, but must also be supplemented in further training courses; faced with the rapid technical progress, there can be no question of waiting for up-to-date knowledge of ITC to be brought in by newly recruited staff. Finally, it appears to be an important criterion that the curricula must embrace not only cognitive knowledge but also emotionally affective and ethical viewpoints.

In its early days ICT training in the German public service was naturally shaped by a relatively small number of autodidacts, followed by the introduction of retraining for those venturing to grapple with these new techniques. Here great service was done, for instance, by the "Kooperationsausschuß AdV Bund/*Länder*/kommunaler Bereich", a joint committee of Federal, Land and local authorities, which reached an agreement in 1973 on a group of training modules for the impartment of basic and specialist data-processing know-how in initial and in-service training courses. Originally conceived for the supplementary training of serving staff (since at that time EDP training did not yet exist as a specialisation in the professional training of future civil servants), in particular the module dealing with basic DP knowledge also gained enormous influence on education throughout the EDP sector. Another trail-blazing event was the founding in 1984 of the "Akademie des Deutschen Beamtenbundes", an academy run by the German civil-service association; here, it was anticipated that the civil service would be deeply pervaded by ITC, and this insight was promoted and translated positively into training programmes.

Meanwhile, civil service training and qualifications in the ICT field have become more routine with relevant provisions contained in curricula for initial and in-service professional training. There is a wide variety of institutions within and outside administrative authorities offering relevant training and development, ranging from universities and polytechnics, to vocational training academies, administrative and economic training academies, data centres, manufacturing companies, consulting and congressmanagement firms to adult evening classes and schools providing general secondary education. As far as the use of information and communications equipment is concemed, but also, to a somewhat lesser extent, with regard to ICT management, education and training opportunities can be easily found by anyone seeking them. Thus any gaps in relevant knowledge within the civil service are due not so much to insufficient "supply" as to a lack of demand.

Since the seventies ICT in public-service qualifications has been given scientific underpinning. Out of the traditional faculties of mathematics, physics and electrical engineering and sponsored by the Federal Ministry for Research and Technology in a supra-regional informatics research programme (Überregionales Forschungsprogramm Informatik), departments of informatics were set up as distinct units, first of all at universities and, shortly after that, also at polytechnics. This was soon followed by the institution of "administrative informatics" and "legal informatics" units as demand oriented computer sciences. Yet these could not rely on promotion through any form of supra-regional research programmes; a

compromise was found by a reassignment of existing staff positions. This may be presumed to be one of the major reasons why the number of research and teaching staff positions for legal and administrative informatics continues to be rather low, with the result that emphasis is mainly on the indirect acquisition of the knowledge required.

To summarise, the race between technological progress and the training of both specialists and "generalists" in the ITC sector, it might be argued, still requires quite considerable effort to sustain it.

V. Technology Policy Background

There is a wide variety of socio-cultural reaction to and assessments of science and technology, including, for instance, reports in the media, technology, research, labour and economic policies, and the establishment of law. The stance taken in Germany vis-á-vis technology is more of the cautious, wait-and-see type, sceptical, critical, even timid or peevish, an attitude, however, that predates ITC. *Arnold Gehlen* remarked with astonishment long ago that one would not expect such polemical anti-technology tones, such resistance to the cultural equality of technology with other fields of culture among a people of such technical ingenuity. In connection with EDP, this again proved to be true. Although the computer was invented in Germany by *Konrad Zuse* in 1936, the practical implementation of an invention, the exploitation of its potential, once again, had to surmount strong mental reservations in this country.

As regards EDP in public administration, these reservations materialised in the form of impact research, a fact which is by no means misinterpreted as an expression of the anxiety that this new technology might change the good old traditional administrative procedure for the worse. There were two prominent fields where this was to be proved well-founded and prevented by counter-measures: the protection of personal data and privacy and the so-called humanisation of work.

In 1970, the world's first data protection law was passed in Hesse - followed by all the other Kand at Federal level with their own legislation, all instituting commissioners for data protection in public administration; this gave Hesse the status of the harbinger of a remarkable debate on technology in Germany. In 1974, the German *Bundestag's* legal committee put a damper on conceptions of integrated data processing, refusing plans for a uniform personal identification mark. In 1983, it was in connection with the population census that EDP came up before the Federal Constitutional Court, an occurrence that met with a surprising public resonance (while, strangely enough, another court judgement delivered in 1977 on intensified information on the general public had gone almost unnoticed). By virtue of this court decision, data protection enjoys the status of a basic right. Individuals have the right of informational self-determination, legitimately deciding themselves in principle whether or not their personal data may be disclosed and utilised. Restrictions are only admissible where the public interest prevails and the law so allows. The relevant pros and cons are thus weighed under the public gaze, which, however, does not lessen controversies, as became evident in the process of amending all data-protection laws following the census judgement as well as in connection with the introduction of specific provisions into laws on internal security or the economic and social systems of order. Another round of amendments was begun in 1995, as the European Union had issued a Directive on data protection, which the relevant provisions in the member states now have to be adapted to conform with.

The humanisation of work, the second key topic in the socio-cultural assessment of information and communications technology, focused on a number of subjects: the fear of layoffs (of human labour) due to computerisation (with "chips for jobs" as a telling slogan), growing alienation due to the intensified division of labour and the monotonous work of "feeding" the computer, the danger of detailed monitoring of employee behaviour and performance, the feared polarisation of staff qualifications (a highly qualified elite alongside working a larger number of dequalified staff), and also the ergonomically correct design of computer workstations. Since 1974 the "humanisation of work" has been promoted by a number of relevant studies under a federal programme.

In the same year, the Federal Personnel Representation Act took effect, reforming personnel representation law applicable since 1955 and strengthening the rights of staff delegates. Under section 75, para. 3, clause 17 of this act (and comparable provisions in the personnel representation acts of the *Länder*), the introduction and application of technical equipment intended to monitor staff behaviour or performances are subject to codetermination on the part of the respective authority's staff council; in case of disagreement, a conciliation board has the right of ultimate decision. Following a supreme-court decision by the Federal Administrative Court in a final objective judgement, this provision is meanwhile open to wide interpretation; accordingly, it is not the subjective intentions of the head of an authority that matter: the only decisive point is whether the computer in question is suitable for employee monitoring. This is the reason why computerisation, in general practice, is subject to codetermination, albeit within the limits of the authority's directorial competency for the organisation and monitoring of performance.

In the meantime, even the trades unions have come to realise that rejecting the 1976 Siemens study entitled "Büro 199V (i.e. "Office 1990", to take just one example) merely on the grounds of its "job-killer" and dequalification aspects was too one-sided a position. Today there is much to suggest that such welcome targets as the protection of jobs would have been better attained by a more positive attitude towards ITC.

Organisational research aimed at utilising the potential of the computer for further improvement to good administrative action is being initiated in Germany, but with some hesitation. Only in the early nineties, when the German economy encountered considerable difficulties on a world market undergoing a process of reorganisation, did it gain ground as awareness grew of the interrelationships between economic prosperity and locational factors within the responsibility of state and administration. Against this background, the discussion on technical progress carried out in the media, in politics, in associations and in science took a clearly different turn. Now, it is widely realised that promoting and utilising information and communications equipment is an absolute must, if we do not want to miss even the last carriage of the train of world-wide economic reorientation, which has been picking up speed for quite some time now. It is also conceded that for at least a decade the opportunities offered by ITC have not been seized resolutely enough. And yet the character of this discussion continues to differ from that in other countries. For instance, visions such as those in Japan and the USA with the target of creating a "fifth computer generation" or a "national information infrastructure initiative" and calling for a concerted effort are uncommon in this country. Even the event of the century, the shift of the German capital from Bonn to Berlin following unification, must be considered from this viewpoint as a missed opportunity (although some interesting development projects have been launched for the future distributed information system "Informationsverbund Berlin-Bonn"). In Germany to date no model has been put up for discussion in political quarters capable of spurring on state, administration and economy in the transition to the information society. There continues to be a lack of a

visionary policy to provide a reliable foundation for decisionmakers and co-ordinating the courses to be taken in such fields as research, transfer, education, economic, labour, and fiscal policy or the promotion of original innovation.

Yet, unmistakably, the discussion has now been opened, and there are numerous initiatives, among them: a 25-member council for research, technology and innovation reporting to the Federal government (which submitted its first 41 recommendations to the Federal Chancellor in 1995); an operation called "Aktion Innovation 96"; a Federal law to safeguard locational conditions for business in Germany (1994 *Standortsicherungsgesetz*); a technology assessment office with a staff of eight (called the "Büro für Technikfolgen-Abschätzung" (TAB)) and reporting to the German *Bundestag* (established in 1993, it draws up reports for the *Bundestag* committee on research, technology and technology assessment); a new working-hours law ("*Arbeitszeitgesetz*" of 1994) admitting greater discretion to employers and employees; a Federal government report (of 1996) "Info 2000: Deutschlands Weg in die Informationsgesellschaft", dealing with Germany's path into the information society; as well as hundreds of different Federal and Land programmes for the promotion of ITC. The European Commission too has given top priority to the development of the information society, for example by means of the liberalisation of the telecommunications market (referred to above) and an outline research programme.

On the other hand, the criticaI socio-cultural attitude towards computerisation has created favourable conditions for a more sensitive attitude towards ITC. The introduction of electronic processing in authorities and the utilisation of its potentials is, after all, not a subject for legal action, but forms part of the development of administration; this process can only be mastered by the joint efforts of all concerned. However, this requires that such attitudes as indolence and reluctance to accept change should be cast off, attitudes which may have sneaked in as a result of the high levels of economie well-being and social security enjoyed by individual employees in Germany. This calls for - as the German Federal President put it in a nutshell – the entire nation to become enterprising once again.

VI. Impulses for New Departures in EDP

The main impetus for the establishment of EDP in the sixties originated from the rapid expansion of public administration following the "economic miracle", an expansion including both the service functions (e.g. in social welfare, health, labour administration and education) and the exercise of powers of state authority (such as fiscal administration, judicial authorities or residents' registration). In view above all of the then tight labour markets, computerisation was the obvious choice for handling these masses of routine functions.

The rising costs of EDP and the danger of incompatibilities among the growing number of computer applications were the principal motives for the alignment phase around 1970, resulting in a system of order – legally underpinned – being established for the EDP sector, which, however – as explained above – was applied not so much b the traditional administration, as by specific authorities and with region-oriented computerisation.

Mainly since the eighties, the rapid pace of technological progress has turned out to be a stimulus calling for some kind of response. A steep increase in the number of workstation computers, networking, software development methods, database systems, a wide variety of application programmes, partly of high complexity, and a rapid succession of updated versions, as well as electronic workflow management – all these developments needed to be

integrated without interrupting normal operations, but are often just added to the existing equipment without a root-and-branch overhaul of the System.

In the mid-eighties there were once again attempts at systematisation, beginning with a *Land*-wide concept for Baden-Württemberg. The intent behind this initiative to organise EDP in public administration is the endeavour to enforce information management for tasks of political and administrative management as well as for the resource information. The critical point is that ITC should be integrated more closely into an authority's traditional procedures of planning and decision-making. The establishing of a central control unit is a step towards ensuring that the potentials inherent in the information and communications equipment, with its ever-increasing capacity for decentral applications, are put to full use to achieve an efficient and low-cost administration.

In the nineties, the implementation of this initiative has been gaining weight as the traditional system of administration is now also undergoing a radical restructuring process triggered primarily by the endeavour to safeguard and improve Germany's attractiveness as an industrial and business location. It is in particular the new international division of labour which clearly shows how greatly our standard of living is dependent upon attractive locational conditions for the economy, locational conditions which are partly influenced by the levels of taxes and fiscal charges, the stability of financial conditions, the degree of regimentation, the duration of administrative procedures as well as the extent to which bureaucratic state functions are delegated to private business. A further impetus for the present reorientation in public administration comes from the population, manifesting itself, for example, in demands for greater transparency and a better service quality of administrative action; and the are other pressures coming from the public Service, arising, for instance, out of the desire for a more challenging working environment with enhanced responsibilities and more scope for independent work. The fact that ITC occupies a pivotal position to providing assistance in all these respects is being realised more and more by those in positions of responsibility. Accordingly, the present main incentive for the further development of EDP in the German public administration may be seen in the opportunity to test new models of administration, to adapt them to the information and communications potential, but also to enable the information and communications sector to provide even better service in respect of the available hardware, system software and application software as well as in its advisory and management-support functions.

VII. Meeting the Challenge of Technological Progress

The speed of technological advances in the information and communications sector is a continual and formidable challenge to public administration and its EDP systems. Over the last decade there have been particularly critical changes in the direction of trends, with the following picture emerging:

- from mainframes via departmental computers, workstation computers and primarily local networking to client/server Systems;
- from stand-alone applications in line with the administration's hierarchical structure to problem-related co-operation and networking of all concerned;
- from separate large-scale applications (like fiscal administration, residents' registration or personnel management), individual special-purpose applications and office communication to integrated user Systems with a uniform user interface;
- from rigid text masks to graphic interfaces, allowing the use of such computers with a certain degree of intuition;

- from procedural to object-oriented programs;
- from hierarchical to relational databases;
- from in-house to standard software based on generally applicable reference models and allowing customisation to individual requirements;
- from proprietary to open Systems and, accordingly, from a seller's to a buyer's market;
- from local and single-medium data to ubiquitous and multi-media data, merging written, pictorial and audible forms of communication;
- from a "patchwork" of administrative data to systematic administrative knowledge graded with the aid of data models and accessible via networks to a wide range of users;
- from semi-skilled EDP staff doing the programming and providing software Services for the applications in their respective branch of administration to highly qualified experts able to recognise correlations between various applications and to ensure an over-arching configuration management;
- from expert-oriented methods of software development to modelling methods safeguarding communication between information and communications experts and users, thus ensuring that their intentions are put into effect;
- from special-purpose EDP authorities to an ICT infrastructure integrated into administrative development via information management by key political and administrative decision-makers;
- from computing centres and computer regions to system houses and consulting firms exposed to competition;
- from EDP utilities financed by scaled contributions to stand-alone service units frequently having to generate most of their budget;
- from application software requiring high levels of maintenance and tending to resist modifications, to information and communications technology providing assistance and capable of responding flexibly to changes in user requirements.
- The changes behind these trends must be considered profound. Have public administration, on the one hand, and the EDP sector, on the other, mastered these shifts? The scene is by no means uniform; yet, broadly speaking, it does not so far really look like it. Externally, this manifests itself in the "productivity paradox", in so far as investments in information and communications equipment have not been followed by commensurate benefits, as well as in a crisis of confidence in EDP, since it has bequeathed the backwash of earlier decisions, considered by some people as burdens that will have to be remedied in the years to come.

In view of ever new generations of information and communications equipment coming available, there would have been a need for an orderly transition in the administrative information systems themselves. A clear course would have had to be pursued from the monolithic mainframes, which initially fitted perfectly into the rule-governed world of administrative bureaucracies (conditionally programmed administrative procedures running smoothly in programmed EDP machines), to the client/server systems available today, capable of supporting co-operative networks instead of hierarchies, such networks fitting well into modern administrative conceptions. But in order to achieve this aim, EDP would have had to be freed from its isolation and integrated into the processes of decision-making in the user administrations; in addition, EDP itself would have had to be debureaucratised, delegating greater responsibility to the specialised administrations, also including responsibility for information and communications equipment, and centralised management and service divisions would have to be set up to this end.

Perhaps this idea was too ambitious. In any event, it was not often implemented. Instead, the mainframes of the seventies gave way to ever new layers of information and communications equipment, comprising the PC in the eighties and LAN-based electronic processing in the nineties, all of them intended to remedy the shortcomings of the previous stage, but also becoming the source of new shortcomings whenever they failed to be integrated into existing systems. This led to add-ons instead of new system designs and thus to a multiplicity of information and communications equipment and applications; in turn, the potential inherent in the new electronic techniques could not be fully utilised, just the thing to provoke the reproach of creating a "productivity paradox" and a legacy of problems for the next generation to sort out.

The way out seems to be obvious: the isolated existence of EDP units and the lack of interest in EDP on the part of political and administrative leaders must be ended. The legitimate interests of EDP users must not be dismissed by those responsible for EDP, but must rather fit into centrally formulated framework plans. Administrative information systems must be integrated into the strategies of administrative development.

VIII. Principle Areas for Electronic Data Processing

1. From Computerisation to Administrative Concepts

The range of benefits derived from ITC by the German public administration extends from the initial conversion of traditional administrative action to a new technique more or less on a 1:1 basis – to recent views of ITC as a catalyst or "enabling technology" for the development of administrative concepts. This confirms another observation by *Arnold Gehlen* according to which, as a general rule, new technologies are initially considered as suitable merely for the rationalisation of existing structures, whereas creative applications allowing a redefinition of the existing landscape will only come into focus following a volte-face in the formulation of the question, as *Gehlen* put it; the specific features of such new technology which are put to use are those which meet the demands and serve the ends of the day. As far as ITC is concerned, these features include the generation of ubiquitous information, which will enable traditional barriers to the reorganisation of administration to be surmounted. Presumably, this will result in a general trend towards a logical concatenation of all information essential to administrative action (organisational intelligence), made available via networks wherever it can be of help in the proper fulfilment of functions in accordance with today's demands for efficient administration. The trend which is beginning to emerge in this regard is outlined below from five perspectives.

2. Trends of Administrative Development Based on Information and Communications Technology

As in many other states, Germany's public budgets suffer from the serious problem of excessive expenditure. The reasons for this are that those benefiting from current programmes defend their interests, and that the various departments providing services set ever higher standards for themselves in the quest for perfection. How can the state regain scope for new, up-to-date service functions? It can safely be assumed that the decisive factors in this area include the availability of information on the justification for and consequences of public action, as well as the political will to put such information to use. Here, ITC can bring its capacities to bear as an "enabling technology" in the construction of information systems, opening up sources of information not accessible in the past, such as product and programme

budgeting, costs and results accounting, comparisons between authorities, public opinion polls, project evaluation, accounting, controlling and many other approaches. Greater transparency regarding the effects of and specific interests in the allocation of resources may well be expected to lead to corresponding demands and support from the public, in turn enabling politicians to take action in conformity with the system. Instituting administrative information systems of this type is a task the major part of which still lies ahead of us. This task must be mastered if public administration is ever to be enabled again beyond formalistic responsibility in the sense of adherence to bureaucratic competencies and regulations – to be in a better position to assume substantive responsibility towards society in the sense of an efficient provision of the necessary public goods, decision supports and data processing – as dealt with in the present paper - being interlinked in this context in a particularly close relationship.

A second trend in present developments in administration lies in the fractal organisation approach. By the uniting of technical competence and responsibility for resources and subsequent delegation, the underlying aim is to achieve more self-determination for every individual organisational unit. This is expected to create greater scope of action and better motivation for the speedy adaptation of administrative action to changed conditions, simultaneously ensuring personal responsibility for the consequences of decision-making. Here again, it is the information systems – this time with a view to the internal relations in public administration – that allow such guidance to be exercised by means of contracts, assigning resources against performance promises and performance control, aided by appropriate information and communications equipment. Further support for the administrative strategy of organisational disentanglement comes from the trend in information and communication technology to client/server systems. These allow administrative information systems to be dimensioned precisely as is considered appropriate by any particular organisational unit. Thus, the greater freedom of public administrations as envisioned by fractal organisation with the concomitants of increased responsibility for results and enhanced performance through a faster pace of innovation has its counterpart in a compatible information and communications infrastructure.

Thirdly, and from a horizontal perspective, the networking of public administrations and their clients provides an impetus to uncover and optimise the working constellations that have already developed. It is assumed that there are considerable potentials for improving the quality of administration as well as for minimising processing times and costs and also for shifting bureaucracy from the public to the private sector. First approaches based on ITC include workflow systems considering administrative procedures from launch to result as process chains and reorganising them on the basis of common updated data and in compliance with the applicable responsibilities and cooperations; and they also include teleco-operation among several authorities, to share tasks, or the intermeshing of the authorities' and clients' information systems by electronic data exchange.

Fourthly, the creation of challenging up-to-date working environments benefits from ITC. For this technology allows functions to be fulfilled in a more holistic and autonomous way, it permits the necessary open communication as digitised information is accessible from the workplace, and it grants greater sovereignty with regard to individual modes of working since it improves flexibility in terms of both space and time (teleworking; part-time jobs; telepresence; teleco-operation; and further modes of working which are rendered possible by the mobility of IT working materials, by the mobility of work results or the attributability of individual contributions to workflow-aided administrative procedures).

Last but not least, the matter should also be considered from the viewpoint of the general public. Here, too, modern ITC has the potential to support up-to-date administrative action. In this regard, mention should be made of the improved transparency it affords with regard to the services offered and sovereign functions fulfilled by the administration, including normative premises and responsibilities, the numerous opportunities to facilitate access to the authorities in line with the trend towards "virtual administration" (such as distributed administration in branch offices "close to citizens", concentrating formerly dispersed services in one place, self-service or mobile administration visiting its addressees as required), as well as of new ways and means for opening administration to the public by electronic record-keeping and new opportunities for ICT-aided participation procedures (even including virtual realities presented with the aid of graphic information systems).

3. Integrating Administration and EDP

lt can be seen from these five perspectives that the existing systems of information always offer answers to whatever questions are put to them. When the questions change in regard to contents, topicality, evaluability, accessibility or presentation of information, the systems of information have to be modified as well. In other words, the strategies of administrative development must be framed with due reference to the administrative information systems, the administrative information systems, for their part, being derived from the administrative strategies. EDP and administration must not be allowed to live separate lives; they must be integrated from the viewpoint of political and administrative leadership. Discussion on this subject has begun in public administration in Germany. What is more, there are concrete examples of the implementation of all five perspectives. Strengthening this trend may well be the principal task for the years ahead.

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